USAID, Sri Lanka Tsunami Reconstruction Assistance Program (STRAP)

Initial Environmental examination (IEE) Report

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USAID SRI LANKA

FACESHEET

INITIAL ENVIRONMENTAL EXAMINATION (IEE)

PROGRAM/ACTIVITY DATA:

Program/Activity Number: (386-05-016)

Country/Region: Sri Lanka / Asia Near East Bureau

Program/Activity Title: Sri Lanka Tsunami Reconstruction Assistance Project (STRAP)

Funding Begin: FY 2005
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IEE Prepared By: Dr. Ananda Mallawatantri, Mission Environmental Officer
Date: May 02, 2005

IEE Amendment (Y/N): N If "yes", Filename & date of original IEE _____

ENVIRONMENTAL ACTION RECOMMENDED:
Categorical Exclusion: ( )
Negative Determination: ( )
Positive Determination: (X)

SUMMARY OF FINDINGS:

The Government of the United States of America intends to provide assistance for several projects in Sri Lanka involving the reconstruction of damaged infrastructure to build a number of infrastructure as a part of its response to the damage caused by the December 26, 2004 Tsunami. The tsunami caused extensive damage to life and property in coastal districts along the eastern, southern and western coasts of Sri Lanka. It is the worst human disaster in Sri Lanka's recorded history.

This Initial Environmental Examination (IEE) was conducted to review the foreseeable effects on the environment as a result of the US Government assisted infrastructure reconstruction and signature projects in Sri Lanka. The IEE covers three types of broadly different assistance activities, namely, the Arugam Bay bridge, roads and area development in eastern Sri Lanka; improvements to three tsunami damaged fishery harbors and related area developments in the southern Sri Lanka; and repair, relocation and new construction of vocational technical educational institutions in several locations in southern and eastern Sri Lanka.

Field visits, stakeholder discussions and literature review indicated that all three key activities pass the threshold environment decision for positive determination pursuant to CFR 216 and require separate Environmental Assessments (EA's).

Although the primary USG assistance is to design and construct signature infrastructure the projects are designed to include extensive involvement of the communities and stakeholders. The objective of the stakeholder involvement is to integrate and ensure the long term sustainability of the benefits that the

infrastructure brings into the community. The process proposed will combine the signature projects with land use planning, livelihood development and adaptation of energy and environmental conservation. In addition to the long-term economic, social and environmental sustainability, the projects are expected to contribute positively towards the peace process and ethnic harmony.

The community consultations, capacity building, education and increased participation of ethnic and disadvantage groups in the projects are recommended for Categorical Exclusion under CFR 216.2 (C) 2 (i).

APPROVAL OF ENVIRONMENTAL ACTION RECOMMENDED:

CLEARANCE:

Mission Director: _____ Date: _____
Dr. Carol R. Becker

Director of Economic Growth:

_____ Date: _____
Mr. Jeffrey H. Allen

Program Officer: _____ Date: _____
Dr. Andrea Yates

CONCURRENCE:

ANE Bureau Environmental Officer: _____ Date: _____
Dr. John O. Wilson

Approved: _____

Disapproved: _____

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Summary of Terms

ADB	Asian Development Bank
asl	above sea level
BOD	Biological Oxygen Demand
CBO	Community-Based Organization
CCA	Coast Conservation Act (of 1997)
CCD	Coast Conservation Department
CEA	Central Environmental Authority
CZMP	Coastal Zone Management Plan
DO	Dissolved Oxygen
EA	Environment Assessment
EIA	Environmental Impact Assessment
ha	hectare(s)
IEE	Initial Environmental Examination
IUCN	International Union for the Conservation of Nature /World Conservation Union
mg/l	milligrams per liter
MSL	mean sea level
NARA	National Aquatic Resources Agency
NGO	Non-Governmental Organization
ppm	parts per million
SL Rs	Sri Lanka Rupees
SS	Suspended Solids
TA	Technical Assistance
UDA	Urban Development Authority
UNDP	United Nations Development Fund
UNESCO	United Nations Education Science and Cultural Organization
USACE	United State Army Corps of Engineers
USAID	United States Agency for International Development
USG	The United States Government
WWF	World Wildlife Fund

1. BACKGROUND AND ACTIVITY DESCRIPTION

1.1 Background

On December 26, 2004, a 9.0 magnitude earthquake struck off the west coast of Sumatra, triggering a massive tsunami that killed more than 250,000 people and displaced thousands in countries around the Indian Ocean. The tsunami caused extensive damage to life and property to all coastal districts along the East, South and West coasts in Sri Lanka.

In Sri Lanka, the tsunami left behind widespread destruction and killed over 39,000 people, destroyed over 100,000 homes, and damaged natural ecosystems and coastal infrastructure. Although Sri Lanka is 1,600 kilo meters (994 miles) away from the epicentre of the earthquake, waves as high as 6 meters (20 ft) crashed into coastal villages, sweeping away people, cars and even a train with 1,700 passengers. It was the worst human disaster in Sri Lanka's history. The percentage of the coastal population affected ranges from about 20% in the southern districts of Galle, Matara, and Hambantota to 80% in the eastern districts of Mullativu and Ampara.

Table 1: Estimates of Livelihoods and Structural Damages in the Coastal Belt of Sri Lanka

Sector	Losses (million $)	
	Assets	Outputs
Housing	290-325	-
Roads	80	-
Water /Sanitation	40	-
Railways	14	-
Education	21	-
Health	57	-
Agriculture	3	-
Fisheries	120	155
Tourism	250	65-130
Power	9	-
Environment	10	-
Total in $ million	**900-930**	**220-290**
Percent of GDP	**4-4.5**	**1-1.5**

Source ADB, JBIC, JAICA and WB

Overall damage is estimated between $900 - $930 million with major losses concentrated in the housing, tourism, fisheries, and transport sectors (Table 1). Total losses across all sectors are estimated to be about 5 % of the GDP of Sri Lanka. The largest share of output losses appear in the fisheries and tourism sectors due to lost income and production. Many coastal fishermen and small scale farmers' livelihoods were impacted by the tsunami causing greater vulnerability to poverty. In addition, many people working in the informal sector who service the fisheries and tourism sectors and communities have lost their homes and livelihoods.

The United States Government provided immediate relief assistance and through USAID, intends to extend the assistance to include post – tsunami infrastructure rehabilitation and development with the objective of "build better."

1.2 Description of Activities

The infrastructure to build includes a replacement of a 500 meter bridge in Arugam Bay, three roads and water sanitation at Arugam Bay; reconstruction and improvement to three fishery harbors at Hikkaduwa, Mirissa and Puranawella (Dondra); and reconstruction and improvements of up to 14 damaged vocational training institutions including two or three new centers in the East and South.

In the process USAID Sri Lanka proposes to include community consultations, coastal management programs and capacity building in local authorities and communities in the areas where the infrastructure will be built. The purpose of linking infrastructure assistance to community capacity building, livelihood and environmental management is to ensure the long-term economic, social and environmental sustainability and ethnic and social harmony in the areas. During the process the projects will introduce and implement improved livelihood programs, educational and training aspects, measures to improve economic gains by fisherman and tourism operators by providing quality value added products and

services and improved service delivery on water, wastewater, sanitation and waste disposal. The buildings and the land use plans developed will include environment and energy best practices such as water and energy saving, erosion control, improved soil water storage, rainwater harvesting etc.

1.3 Purpose and Scope of IEE

This Initial Environmental Examination (IEE) was conducted to review the foreseeable effects on the environment as a result of the US Government assisted infrastructure reconstruction and signature projects, as a response to the December 26, 2004 tsunami. The key activity areas covered include 1) Arugam Bay signature infrastructure bridge construction and area development, 3) rehabilitation of three fishery harbors in the south (Hikkaduwa, Mirissa and Puranawella) and associated area developments and 3) reconstruction and new construction related to vocational and technical educational centers in the coastal area impacted by the tsunami.

Due to the wide variety of projects involved, this IIE was designed as a programmatic IIE and each major activity is dealt with separately. The possibility exists that USAID Sri Lanka may add another road activity (Muttur area road and bridge development) later to the same project portfolio when this IEE will be updated and expanded. Literature collected from multiple sources (Government of Sri Lanka Agencies at national and local level, regional bodies and NGOs), field visits and a number of discussions with the communities in Arugam Bay and fishery harbor locations provided the information for the IEE. More discussions with the communities and stakeholders are expected during the project formulation and during the EA process.

We would like to acknowledge the contributions of the staff of the Government of Sri Lanka offices of the Central Environmental Authority, the Ceylon Fishery Harbor Corporation, the Coast Conservation Department, the National Aquatic Resources Agency, the Road Development Authority of Sri Lanka, Urban Development Authority and Vocational Training Authority; Consulting companies ARCADIS Euroconsult and EML Consultants; non-governmental organizations Arthacharya Foundation, Environmental Protection Foundation, HELP-O, Mercy Corps and Rebuild Sri Lanka Trust; the USAID staff in Egypt, India, Sri Lanka and Washington DC; and US Army Corps of Engineers based in Hawaii, Korea, Japan and Washington D.C, for their valuable contributions by way of providing information, concepts, ideas and encouragement.

2. COUNTRY AND ENVIRONMENTAL INFORMATION

Land and climate:
Sri Lanka is an island the size of West Virginia located between latitudes 6 to 10 degrees north and longitudes 79 and 82 degrees east off the southern tip of the Indian subcontinent. Its total terrestrial area is approximately 65,610 square kilo meters (25,332 sq. miles), of which 64,740 sq. km (98.7%) is land and 870 sq. km (1.3%) is water. About 13.9% of Sri Lanka consists of arable land, with 15.7% in permanent crops and 70.4% in other uses (2001). Irrigated land area is about 6,510 sq km (2,514 sq mi) in 1998. Sri Lanka has 1,340 km (833 mi) of coastline. The extent of the territorial sea and the Exclusive Economic Zone (EEZ) is 21,500 km2 and 517,000 km2, respectively; the EEZ amounts to 7.8 times the total land area of the country.

Sri Lanka is richly endowed with water resources that are replenished mainly by rainfall. The mountain massif of the central highlands contains peaks of up to 2,500 meters in elevation. All the major rivers start in central highlands and flow into the ocean creating 103 river basins. The climate is moist tropical/subtropical, with monsoon rains falling during May-September (South-West) and November-February (North-East). Average annual rainfall ranges from 1,500 mm to 2,500mm. Mean annual

temperature ranges from 27°C in the lowlands to 15°C in the central highlands, with little seasonal variation. Frost occurs occasionally in some parts of the central highlands.

Demographic and socio- economic status:
The human population of Sri Lanka had reached 19.3 million in 2003, with an annual growth rate of 1.3%. Per capita annual income is estimated at 935 US $ in the year 2003. Birth rates (2.1 per woman) and infant mortality rates (15 per 1000 births) are relatively low by associated developing country standards. Approximately 22% of the population lives in urban areas and 34% in coastal areas. Ethnic breakdown of the population is Sinhalese (74.0%), Sri Lanka Tamil (12.6%), Indian Tamils (upcountry) (5.5%), Muslims (7.1%) and others (0.8%). In 2003 the GDP consisted of Agriculture (19%), Industry (26.5%) and Services (54.5%).

Biodiversity:
Sri Lanka is ranked by IUCN, UNESCO, WWF, Conservation International and other conservation entities as a biodiversity "hot-spot" of major global importance due to the presence of important tropical forest and coral reef habitats, and the high proportion of endemic species of plants and animals within these habitats. More than 50% of Sri Lanka's reptiles and amphibians, 25% of its plants, and 17% of its mammals are endemic species. Most of the endemic animal and plant species inhabit the rain forests of the wet zone that include the coastal area affected by the December 26, 2004 tsunami.

Table 2: Endemic, Threatened and Endangered Species in Sri Lanka

Category	Total number of known species	Endemic species	Threatened& endangered
Plants	3,414	890	431
Birds	251	25	11
Reptiles	144	77	8
Amphibians	39	20	(no data)
Freshwater Fish	65	17	8
Mammals	88	5	14

Source: IUCN

Sri Lanka's coastal region contains highly productive marine ecosystems, including coral reefs, mangroves, salt marshes, lagoons, estuaries and barrier beaches and dunes. An estimated 2-3 % of the coastline has fringing reefs. The reef ecosystem a rich diversity of both fauna and flora, including 183 species of hard corals, more than 300 fish species, turtles, dolphins and numerous invertebrates. However, the status of coral reef health has been declining due to a variety of threats; according to the most recent report from the Global Coral Reef Monitoring Network, an estimated 35% of reefs are now classified as "dead" and 45% are "threatened".

Coastal ecosystems:
Out of the 25 administrative districts in Sri Lanka, 14 districts have maritime boundaries. Based on the administrative districts the coastal areas consist of 24% of the total land area. Coastal and marine environments are intrinsically linked with the country's society and economy. From scenic sandy beaches to mangrove forested estuarine areas, these often fragile ecosystems provide the basis for the marine fisheries industry, coastal tourism and a host of other related economic and social benefits. For example, the coastal reefs especially in the southwest of the island play a vital role in mitigating the impacts of the waves and reducing coastal erosion.

The vast majority of the fish catch (85%) comes from marine sources and is estimated to be about 183,000 tons annually. Although fishing contributes only 2.6% of GDP, fish is the major source (over 60%) of animal protein in the Sri Lankan diet and fishing supports about 500,000 people. In addition to the food value of the fish, many reef fish species are much sought after in the ornamental fish trade. The coastal environment is being seriously degraded by various forms of pollution, silt deposition, erosion compounded by sand and coral mining, conversion to tourist facilities, and the loss of mangroves. Sri Lanka has several hundred miles of coral reefs; 120,000 ha of brackish water lagoons, estuaries, and

mangrove swamps; and about 140,000 ha of freshwater tanks and reservoirs provide the basis for productive marine and inshore fisheries.

Population growth, expanding tourism, industry, and urban settlements, migration of people towards the coast and widespread poverty, continue to contribute to the depletion of coastal resources and the degradation of coastal environments. Freshwater resources are being polluted by industrial waste and sewage run-off. Much of Sri Lanka's mangroves, an important coastal habitat, have been cut down to make way for farmland and fish cultivation ponds.

The key environmental issues in the coastal zones are; loss of habitats and nursery grounds; overexploitation of coastal resources including food fish, ornamental fish, sand, and coral limestone; destructive fishing practices, such as the use of dynamite; and marine pollution. Pollution in the marine environment is causing reduced growth in coral reefs and other living organisms, health hazards for recreational users, and reduced fish production. An assessment of the viability and sustainability of the offshore fishery is needed.

The December 26, 2004 tsunami severely affected the coastal ecosystem in Sri Lanka as it impacted more than 70% of the coastal belt extending from Jaffna in northern Sri Lanka to Negambo in the western Sri Lanka.

Human induced pollution:
Air Pollution has serious effects on biodiversity. In Sri Lanka primary emission sources are automobiles, power plants and industries. The main pollutants are sulphur and nitrogen compounds, hydrocarbons, carbon monoxide, acid and other chemical fumes and particulates. Trans-boundary pollution such as the Atmospheric Brown Cloud is a new concern in Sri Lanka. Neighbouring India uses coal fired power plants with high sulfur coal that also has effects in Sri Lanka.

Sri Lanka is trying to address the solid waste management problems related to disposal of domestic, municipal wastes, agricultural wastes as well as hospital, industrial and other forms of toxic wastes. The quantities of waste are expected to increase with continued economic development and this has implications on the ecosystems, especially in terms of land-based marine pollution sources. There is little treatment of municipal and industrial wastewater, and therefore the receiving waters are considerably polluted. The Kelani River providing drinking water to the City of Colombo and many other areas receives untreated effluent from more than 20 industries and untreated sewage.

The tsunami related reconstruction and rehabilitation assistance could positively contribute towards reducing human induced pollution. The programs may bring communities and authorities together, increase enforcement of regulation, build capacities in local authorities and communities to understand the impacts of pollution and adoption of environmental, livelihood and other best practices to promote sustainable socio economic development.

2.1 Locations Affected

Figure 1: Arugam Bay Site location

2.1.1 Pottuvil – Arugam Bay Area

Climate:

The Arugam Bay in the eastern coast is located within hot, humid, tropical dry zone of Sri Lanka. The mean annual temperature is 27.4º C ranging from 18º C on cooler nights during the rainy seasons, to 38º C day time peak in the summer months. The average daily maximum and minimum are 30.6ºC and 24.3ºC, respectively. The eastern province where Arugam Bay is located receives an annual average of about 700-1700 mm of rainfall with 60% during the northeast monsoons between October to February. Winds during the monsoon originating in the ocean brings relatively little precipitation while the inter-monsoonal convectional rains account for the majority of rainfall with some rain falls during the southwest monsoon. Rainfall distribution, therefore, is important in determining the climatic conditions in the area. Most of the province has a dry spell of three months with fairly dry conditions prevailing between May - September. Winds are generally moderate, ranging from 7–15 km per hour with stronger winds during the evening.

Immediate damage from Tsunami

According to the post-tsunami assessment by "Arcadis Euroconsult", the tsunami damage and direct effects on beaches and dunes are immediately visible and large amounts of debris was scattered along the high water mark. This included organic matter (varying from branches to whole, uprooted trees), dislodged coral boulders and marine rocks, rubble from destroyed buildings, and large amounts of household waste. There has been significant erosion in some areas, and dune vegetation has suffered some damage, although this is usually limited to the most exposed (a belt of 10-15 meters) or eroded areas.

Damages to vegetation:

Lagoon mangroves suffered limited impacts. Mangroves located directly near the seaward part of the lagoons were affected more. At the mouth of the Pottuvil lagoon mangrove trees had been dislodged, snapped off at the base, or entirely stripped of branches. The Surfing point in Arugam Bay, at least 10 meters of dune was lost on the exposed side. A band of woody vegetation of about 15 meters on the bay side was destroyed. Both coconut and Palmyra trees have remained upright and have not been uprooted. However, the palmyra palms (*Borassus flabellifer*) have been killed due to salt water intrusion into the freshwater stored in the soil. In contrast many of the Coconut palms have survived as these can withstand saline conditions.

Changes in the lagoon environment

The tsunami has also changed the lagoon environment in Arugam Bay. The addition of a large amount of decomposing organic matter in the lagoon may lower oxygen levels, but there was no visible evidence of fish kills attributable to this phenomenon. The Arcadis Euroconsult team who worked on the ground in Arugam Bay reported that the decomposition was causing some disagreeable odours around some lagoons, which is a nuisance to local communities, but not considered a health hazard. The reason that anoxic conditions have not led to fish kills is attributable to the fact that the tsunami has opened up direct links with the sea in many of the lagoons. This brings in oxygen-saturated waters that may have reduced

the anaerobic decomposition that caused the odour. In some instances the link has been temporary, with a sand bar quickly forming again near the mouth (e.g. Arugam Lagoon). The influx of seawater has increased the salinity in many lagoons, but this could be temporary. The rains that followed shortly after the tsunami would have contributed to diluting the system.

Impact on transportation, water and electricity supply

Roads have been heavily hit by the tsunami, with many road sections washed away, or undermined by deep scouring, usually on the landward side of (elevated) roads. A large section of the bridge at Arugam Bay was destroyed, and only recently (9th March 2005) re-opened after Bailey bridge sections were installed by the Indian army. Until that time, crossing was possible by boat service across the lagoon, driving on the sand spit at the mouth of the lagoon or taking the emergency jungle road (a detour of 11km) that was cleared to increase access and facilitate the relief operations in the area.

Wells in the affected areas are generally still brackish, although much pumping has occurred and is still ongoing. Usually, if wells have been overtopped by seawater, a 'bubble' of brackish water is formed at the base, and this simply needs to be pumped out. In affected areas in Pottuvil and Arugam Bay the problem seems much more serious as most attempts at desalinisation have failed. It appears that seawater has intruded into the groundwater system, and a coastal freshwater 'wedge' has been displaced, at least momentarily. Large polyester or corrugated iron tanks have been installed throughout affected areas (mainly by NGOs and private sector), and these are being serviced by tankers. Power and telephone lines were knocked out by the tsunami, but were soon repaired and are now restored in most areas serviced before the tsunami.

Local government services in drainage and waste management

Drainage networks in towns and villages were modest at most before the tsunami and have not been restored as this is not yet a priority. Solid waste disposal was also not adequate with only 20-25% being collected in Pottuvil town before the tsunami. Sanitary dumping sites are also non-existent in the area. Post tsunami the waste issue has been greatly amplified and a solution in needed.

Disposal of solid waste by the Local Authorities occurs at a number of sites around Pottuvil. There is no prior sorting of waste, and all the waste is transported by the tractor-trailer to the dump sites and deposited on the surface. The waste is regularly burnt to prevent build-up. Prior to the tsunami, two sites were in use, while a third had been discontinued due to complaints from a nearby police station. Both sites still being used are located in small clearings in forested areas – one immediately adjacent Lahugala National Park – and this attracts wildlife, judging from the presence of animal dung around the site (especially elephant).

There is no sewerage system in the area, and most have either soak pits or septic tanks, or (in the case of migrant fishermen, for example) simply make use of the cover of coastal scrub.

Cultural sites

Pottuvil's most noteworthy archaeological site is the 2000 year old Magul Maha Viharaya temple, which was apparently discovered only 60 years ago, although it lies just on the outskirts of Pottuvil (UTM: 0592719/0759235), at the base of the Pottuvil dunes. The site consists of the temple platform, several pillars, and three large statues. The site has not been affected by the tsunami, as it was shielded by the tall dunes.

2.1.2 Fisheries Harbor Areas at Hikkaduwa, Mirissa and Puranawella (Dondra)

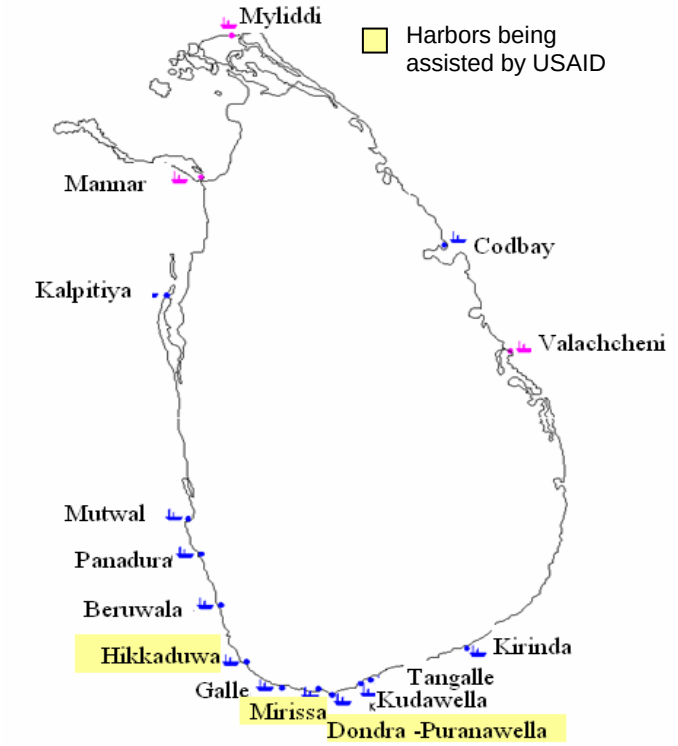
The tsunami affected the infrastructure of fishery harbors, landing points and the reefs in the south west, south, east and north-east. A number of donors and Sri Lankan entities came forward to rebuild and improve these harbors and to provide fishing gear. The United States Government has agreed to improve the conditions in three harbors, namely, Hikkaduwa, Mirissa and Puranawella (also referred to as Dondra).

Table 3: Number and Types of Fishing Boats registered at Hikkaduwa Mirissa and Puranawella (Dondra) Fisheries Harbors

Size class	Dondra	Hikkaduwa	Mirissa
No Engine	50	11	-
On board motor	12	-	-
18"	-	-	-
28"-30"	25	28	64
31"-35"	129	17	48
36"-40"	94	4	41
41"-45"	17	1	10
>45"	-	-	-
Total	327	61	163

Source: Ceylon Fisheries Harbor Corporation

Figure 2: Fisheries Harbors in Sri Lanka



Hikkaduwa Fishery Harbor

Hikkaduwa harbor is located 100 km southwest of Colombo and the Fishery Harbor is in the heart of City. Hikkaduwa is a very attractive tourist center due to the presence of submerged coral in the near shore area. A large number of fishing boats anchored in this are that was a Marine Sanctuary and they have now shifted into the harbor that was built in 2001. The administrative district is Galle and the divisional secretariat division is Hikkaduwa. The harbor presently has a capacity for 350 boats with a land area of about 0.54 ha and a basin area of 6.9 ha.

Hikkaduwa town covers about 325 ha in eleven Grama Niladari divisions (smallest administrative unit) with average population about 3,000 people. Number of hotel rooms in Hikkaduwa is about 1,170 with about 70% and 30% occupancy in high and off seasons, respectively. The average amount of garbage residents generate is about 0.35 kg/day while a tourist generate about 2.44 kg/day. City of Hikkaduwa will be getting a new waste water system in 2006 and the plan for the new sanitary landfill site is drawn but stalled due to public opposition and lack of funding.

The near shore area of Hikkaduwa consists of patches of sand (fine sand with mean diameter about 0.1 mm) interspersed with coral rocks. Past studies (1991, 1996) shows removal or loss of sediments between the reef and the shoreline (Lanka Hydraulics Ltd, 1996) at the average rate of about 5,000 cubic meters per year. The observation made was that either the sand is being trapped in the river (confluence north of

harbor) or transported north of the town of "Seenigama." Somewhat uniform special distribution of the calcium content and the high percentage (15% - 25%) indicates the reduce discharge of river sediments to the sea. However it is also observed that during dry spells the river act as a sink of sediments and after rains it discharges sediments to the reef and some sand is transported north by the currents.

Before the harbor construction (breakwater) the waves traveling south reached the shore about 250 meters south of the harbor (presently a marine sanctuary with protected revetments). Immediately after the harbor breakwater construction some of the wave action on the south side of the breakwater was observed and the reflected waves traveled in the south easterly direction. However further investigation on this aspect is recommended. The breakwater provides a larger basin area by sheltering the northern basin. It also prevents sediment flow from the river mouth into the harbor basin.

Mirissa Fishery Harbor

Mirissa harbor is located about 154 km from Colombo west of the Matara town in the Matara Bay. The administrative district is Matara and the Divisional Secretariat area is Weligama. The harbor was commissioned in 1966 and it has a land area of 1.54 ha and a basin area of approximately 7 ha. The main breakwater is about 450 meters long and the depth of the harbor varies between 2.5 – 3.0 meters. Berthing capacity at present is for 250 vessels with 3.5 to 5.0 ton capacity and the harbor is over crowded and many delays occur due to the lack of berthing capacity. As a result only about 170 boats are registered in the harbor. It may be worthwhile to investigate the reasons in detail.

Opportunities for private sector involvement at the Mirissa Fishery Harbor lie in the boat repair facilities. The nearest slipway is in Tangalle 40 Km away and therefore there is justification for a Slipway at this harbor due to its size, supported by several small workshops. The location of Mirissa may provide opportunities for developing a "Marina" for yachts as a future development plan.

The tsunami damages as well as the need for expansion provides USAID an opportunity to assist in the rebuilding of the Mirissa harbor. Some of the facilities at the Mirissa Fishery Harbor are very old, the workshop and winch were commissioned around 30 years ago.

Dondra (Puranawella) Fishery Harbor

Dondra harbor is located 165 km south of Colombo and west side of the "Dondra Point" the southern most tip of Sri Lanka at the eastern end of the Matara Bay (latitude 5° 56'N and longitude 80° 35' E). The Nilwala Ganga, one of the major rivers, flows out to the sea nearly 5 km to the west of the harbor. The administrative district is Matara and the district secretariat division is Devinuwara.

The construction of the harbor started in 1982 and was expected to provide facilities to 450 boats if the full area of the harbor can be used. However the shallowness (dead coral mixed with sandstone) does not allow the full use of the harbor area. According to Ministry of Fisheries and Aquatic Resources (1995), about 650 boats with in-board engines, a large number of out-board engines and non-mechanized crafts operate from the coastal stretch of 30 km between Dondra and Tangalle. Tangalle harbor accommodates about 100 boats; therefore, the expansion of the Dondra harbor is justifiable but also must keep in line with plans in Tangalle.

2.1.3: Vocational and Technical Education Centers

Repair and reconstruction of up to 14 facilities with interventions varying from repairs to buildings to replacement of equipment to designing and constructing two to three brand new facilities to either combine several damaged facilities or to implement a new curricula designed by USAID together with Vocational Training Authorities of Sri Lanka.

Table 4: Indicative list of some of the Vocational Training Centers and Damages that Could be Assisted Under this Project

	Facility	Location	Scope
1	Training Center	Urawatta, Ambalangoda	Repair
2	Printing Center	Pettigawatte, Galle	3 Story
3	Relocation	Galle	2 Bldgs
4	New Site	Galle	3 Bldgs
5	Weligama Center	Weligama	3 Bldgs
6	Ahangama	Imoduwa	3 Bldgs
7	Matara Relocation	Talalla	9 Bldgs
8	Nintava	Nintava	2 - 3 Story

Source: Vocational training Authority, Sri Lanka

In order to add value to the new centres, the aims is to build in "Green Design Concepts" and adapt energy and environmental best practices into the construction. The buildings will then have an educational role for the community and the students benefiting from the facility. Some may have residential facilities therefore, the liquid and solid waste generation could be significant. All these design aspects and facilities would require higher environmental control features to be incorporated into the design and build process.

2.2 National Environmental Policies and Procedures

Some of the relevant regulations and acts include the National Environment Act No 47 of 1980 (NEA) and its amendments in 1988 that is the national charter for protection and management of the Environment, the Coast Conservation Act No 57 of 1981, and the standard Environment Impact Assessment (EIA) procedure. The EIA procedures applicable today are based on the Gazette (Extra – ordinary) No: 772/22 dated June 24th, 1993; No 859/14 dated February 23rd, 1995; No 1104/22 dated November 6th, 1999; No 1108/1 dated November 29th, 1999 and No 1159/22 dated November 22nd, 2000 of the Democratic Socialist Republic of Sri Lanka.

The EIA process is managed and monitored by the Central Environmental Authority (CEA) and implemented through a number of State Agencies designated by CEA as Project Approving Agencies (PAA). The NEA identifies two levels in the EIA process. The first level is the Initial Environmental Examination (IEE) that identifies the potential environmental impacts of the proposed project with a view to determine whether the impacts are significant or not. The second level is the Environmental Impact Assessment (EIA) which is a

Coast Conservation Act 1981 (No. 57 of 1981) has 42 sections that covers: Administration (I); Coastal Zone Management (II); Permit Procedure (III); General (IV); Amendment and Modification of Certain Written Laws (V).

A Coast Conservation Advisory Council has to be established along with an appointed Director of Coast Conservation (secs. 2-10) who will submit to the Council a comprehensive Coastal Zone Management Plan.

Section 16 provides for environmental impact assessment to be provided by applicants for permits to engage in developments activities in the Coastal Zone other than prescribed development activities.

Coastal Zone is defined as *"the area lying within a limit of three hundred meters landwards of the mean high water line and two kilometers seawards of the mean low water line and in the case of rivers, streams, lagoons, or any other body of water connected to the sea permanently or periodically, the landward boundary shall extend to a limit of two kilometers measured perpendicular to the straight baseline drawn between the natural entrance points thereof and shall include the waters of such streams and lagoons or any other body of water so connected to the sea*" (sec. 42).

Source: FAO stats

more comprehensive document where alternatives to the project and mitigation measures are identified.

The IEE/EIA process in Sri Lanka is project-based and the projects in the coastal areas are covered by the Coast Conservation Act (CCA) of 1981 that regulates the land area within a limit of 300 meters from the Mean High Water line and a limit of two kilometers seawards of the Mean Low Water line.

CCA does not specify when an EIA is required for a particular project, but generally the Coast Conservation Department (the regulatory agency for the CCA) interprets this provision as that "an EIA is required when the impacts are likely to be significant". An exception is made for 'environmentally sensitive areas' (ESA) in the coastal zone; projects in ESAs are subject to regulations as determined by the National Environmental Act No. 56 of 1988. Projects outside the coastal zone and in ESAs are to be cleared according to procedures determined by the NEA (1988). In an Order published by the Ministry of Environment in 1993, it was determined that IEE/EIA are to be conducted only for a prescribed list of 31 (types of) projects. IEE/EIAs are to be cleared by Project Approving Agencies (PAAs), of which 14 are designated in an order published by the Ministry of Environment in 1993.

The IEE/EIA process (as determined by the NEA) involves an initial scoping process that will lead to a threshold determination on whether an IEE or an EIA is required based upon the preliminary investigation based on the scoping. The IEE or EIA developed is subjected to public inspection and comment for a mandatory period of 30 days. Then the public inputs are referred to the project developers and upon submission of revisions of IEE or EIA, the PAA is approved or disapproved. For the rejections the project proponent can appeal to the Secretary of the relevant Ministry. The decision on an appeal is given following a series of technical evaluations and/or public consultation and the decision on the appeal is final and legally binding. Following approval, a project monitoring committee is formed to monitor the project implementation.

IEEs/EIAs are required for solid waste disposal facilities that have a capacity exceeding 100 tons per day. None of the project sites covered in this IEE collects more than 100 tons of municipal solid waste per day. However we recommend evaluation of the solid waste management in the project areas as the potential for higher growth and significant increase in the generation of solid waste is anticipated in the project areas.

The first comprehensive National Action Plan in Sri Lanka came into effect in 1992 and the present National Environmental Policy is outlined in the document named "Caring for the environment 2003-07" by the Ministry of Environment and Natural Resources.

3. EVALUATION OF ACTIVITY/PROGRAM ISSUES WITH RESPECT TO ENVIRONMENTAL IMPACT POTENTIAL

3.1 The Arugam Bay Bridge and Related Structural and Participatory Coastal Management Components in the Area

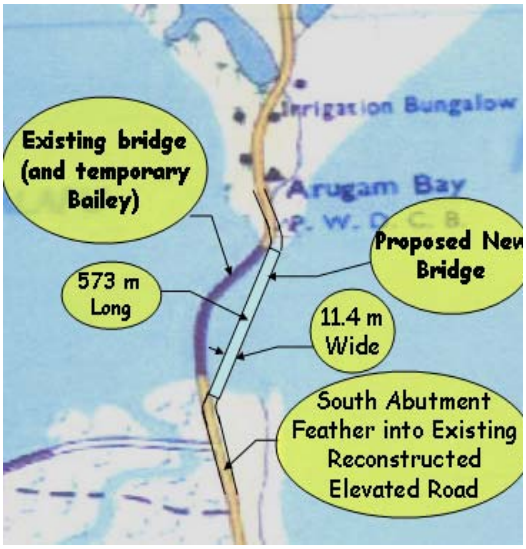
3.1.1. Brief Description of the Arugam Bay Bridge Specifications

The existing Arugam Bay Bridge is located approximately one mile south of Pottuvil about 400 km from Colombo. The existing bridge is a steel truss bridge with a total length of 152 meters consisting of four equal spans, each 38 meters long. The bridge cross section consists of 6.7 meter clear carriageway and 0.4 meter wide sidewalk on either side. The bridge was also connected to a 550 meter long causeway and a separate single span concrete bridge on the south side. The Tsunami completely washed off the

causeway on the south side leaving a gap of about 500 meters. The Tsunami also changed the width of the bay at the bridge. The width of the bay at the bridge was approximately 150 meters, but after the Tsunami, the width of the bay has increased to more than 260 meters. A temporary 4 span Bailey bridge was constructed to span over the additional 110 meter of waterway caused by the Tsunami. The temporary bridge over Arugam bay now consists of four spans existing steel truss bridge connected to a four span bailey bridge for a total bridge length of 262.8 meters.

Proposed Arugam Bay Bridge:
Design and Construct a replacement bridge on a new alignment and on the east side of the existing Arugam Bay Bridge. The total length of the new bridge will be about 686 meters long. The total width will be 11.4 m to provide 7.4 m carriageway for two lanes of traffic with 2.0m wide foot walks on either sides. The foundation will be either large diameter bored piles or large diameter caissons taken to bedrock. The same free board shall be used as the existing bridge. The same vertical clearance shall be maintained between the soffit of the superstructure and to the waterway below. The vertical profile of the approaching roads and bridge will require adjustment to accommodate the depth of the new superstructure. The new bridge will be of concrete construction. The existing bridge will be used as a detour until the new bridge is constructed. The existing bridge will be removed and the existing causeway demolished after the new bridge is operational.

Figure 3: Location of the Present and Proposed Bridges at Arugam Bay



The Superstructure will consist of five 1.8 meters deep Post-Tensioned concrete girders, spaced at 2.4 meters center to center spacing.

The bridge will consist of twenty one 32.7 m long spans. The deck will either be 200mm thick cast in place concrete crowned at the center with 2% slope, or 100mm thick pre cast deck with 100mm thick cast in place concrete topping crowned at the center with 2% slope. A 7.5 meter long approach slab should be provided at each approach of bridge to give a smooth riding surface at the road/bridge transition.

The substructure consists of twenty intermediate CIP (cast in place) bents and two CIP abutments at the ends of the bridge. The piers will utilize two 1.2 m diameter bored piles and 1.5m by 1.5m bent caps spanning between the bored piles to support the superstructure. The 1.2 m bored piles should be socketed 4 meters minimum into bedrock. The elevation of the bedrock varies between 27.4 m to 33.4 m below the Ordinary water level (OWL). The abutments will consist of Reinforced concrete retaining wall supported on a pile cap utilizing 0.6 m diameter bored piles. To resist a combination of forces (overturning, vertical and lateral forces), the piles at the abutment will either be staggered spacing or double row. Reinforced concrete wing walls will be required to retain the fill behind the abutments. The wing walls will also be concrete retaining wall supported on a pile cap utilizing 0.6 m diameter bored piles.

The new bridge will eliminate the need for a causeway on the south side which restricted the lagoon water flow and could not resist the intensity of waves and water flow at turbulent weather. The new bridge will have a more direct alignment with the existing roads on the north and south approaches and will be 3.8 meters wider than the existing steel truss bridge to accommodate future widening of the approaching roads. The new bridge will require minimal maintenance since it will be constructed with concrete as

opposed to the steel bridge that lacks durability in the salt water environment. Restoration of the wetlands as a result of eliminating the causeway is a direct environmental benefit.

Figure 4: Proposed Arugam Bay by-pass road and bridge locations

3.1.2 Bypass road construction

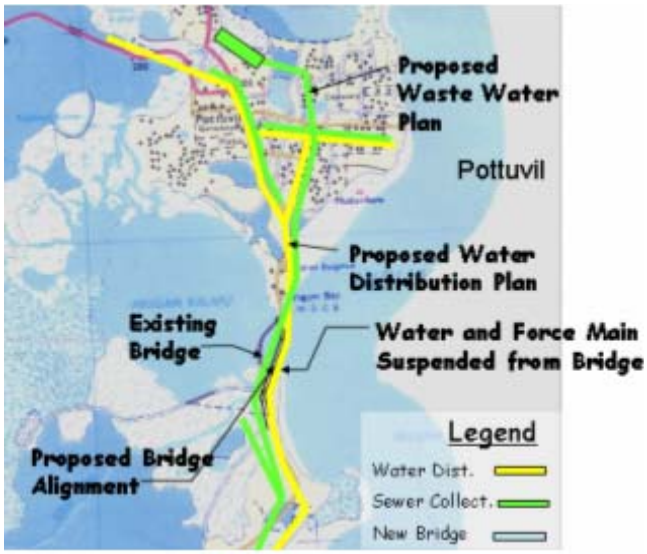
Arugam Bay Bridge Roadway Approach (Optional). Design and construct 500 meters of approach roadway at both ends of the new Arugam Bay Bridge. The Arugam Bay bypass road will be a new two lane 24 foot wide asphalt road around the Arugam Bay. The new road will run north from Panama and then connect to Highway 4 just west of Pottuvil. The road will be approximately three (3) km in length and pass through wetlands.

3.1.3 Water and Sanitation development and land use planning in Arugam Bay area

Arugam Bay already reports problems with water availability and quality. Socio economic growth, improved quality of life of the citizens in the area and the growth of key areas such as tourism development rely heavily on the management of water and sanitation in the area.

The sources of water needs to be identified by working with the local authorities, community and the National Water Supply and Drainage Board (NWSDB) that has a regional office at Ampara. The initial scoping conducted in February by USACE indicated the possibilities of conducting a ground water exploration or evaluating the possibility of getting water from a nearby surface water body.

Figure 5: Arugam Bay area water supply lines and the proposed bridge locations



3.1.4 Integration of infrastructure development with Sustainable Socio - Economic Development

In order to bring the maximum benefit of the infrastructure projects proposed to Arugam Bay area to the larger society, community consultations and development of an integrated area management road map is proposed. It will include elements of Participatory Coastal Zone Management (PCZM) and capacity building of local authorities, businessmen, government officials involved in Arugam Bay area development and the citizens.

3.1.5. Implementation Plan

Activity / Phase	Year 1	Year 2	Year 3	Year 4
	FY 2005	FY 2006	FY 2007	FY 2008
Draft RFP and IEE				
Pre - Bid Conference				
Community consultations/building linkages				
Final RFP and Award				
EA's Govt of SL and USAID Approvals				
Official Inauguration of the project				
Geotechnical Investigations/ Surveys				
Designing of the Bridge and Water Sanitation				
Designing of roads				
Integration of area development				
Bridge and roads constructions				
Water Sanitation construction				
Local authority/ community capacity build.				
Community development programs				
Environmental monitoring				
Project monitoring and evaluations				

3.1.6 Evaluation of Environmental Impact Potential and Recommended Mitigation Actions

	Component	Environmental concerns	Mitigation
1	Integration of the community to design a road map for area development including infrastructure	• Community lacks awareness of the impacts and potential benefits.	Conduct a number of consultations with the community on what their roles are and the possibilities the changes will have to improve their quality of life.
		• Possible lack of community support for the project due to ethnic composition and different interests (three ethnic groups at varying degree of education).	Involve the community at the outset of planning and designing. Create an ownership for the infrastructure and use infrastructure as a way to promote a number of sustainable economic, social, governance and environmental best practices.
2	Capacity building of the stakeholders in project design, identification of needs and improved monitoring and accountability	• Poor capacity of the local authorities, area businessmen, government agencies to engage the community and implement participatory development.	A dynamic well thought capacity building plan is necessary to overcome the barriers in this area. Participatory coastal zone management programs along with livelihood enhancement schemes may help and some plans are available.
		• Underestimation of the value of monitoring and evaluation of the changes (social, economical and	Include monitoring concerns in the design and planning. Build the capacities of the local authorities and stakeholders.

	Component	Environmental concerns	Mitigation
		environmental) as a result of the project.	Provide technical assistance mainly using local expertise. Proper understanding of the benefits of the project and the expected increase in the ability to pay for services (for sustainability) could change the dynamics of among the local authorities, citizens and businessmen in the area.
3	Providing facilities for building workers during the construction	• Water and sanitation issues by camping on site that is near a wetlands (both bridge and road projects).	Plan for off – site accommodation and to construct water and sanitation facilities for the workers considering the sensitive sandy soils and potential to pollute ground water in the area. Design and implement solid waste management systems
4	Designing the bridge, roads and water sanitation.	• Displacement of the people.	Work with local authorities and planners. Few problems expected as most of the land is state owned.
		• Routes to bring in supplies.	May use the old bridge to a certain extent and minimize creating new roads that encourage illegal logging and poaching. This issue came up during the humanitarian assistance phase when an alternate road was made through the jungle.
		• Water flow path modifications due to excavations on the ground and in wetlands.	Drainage flow paths should not be disturbed. Adequate planning is needed at the design stage to avoid siltation of wetlands and water bodies. Accumulation of water may lead to disease.
		• Design surface cover methods such as landscaping and compaction to minimize erosion related transport of soils into wetlands and water bodies. Both wind and water erosion could be high.	Prepare adequate drainage and storm water systems. Adopt methods to increase infiltration into soils such as planting cover with the help of coir materials that can be produced in the area. Consider making compost as part of the project and use in erosion control and enriching sandy soils.
5	Construction of the bridge and roads	• Potential damages by excavations. Runoff of excavated materials into wetlands and unwanted locations can be a serious issue in Arugam Bay.	List out the potential damages and take precautions. Excavated areas can be dangerous to inhabitants in the area. Take necessary safety precautions.
		• Noise and dust.	Minimize by staggering the noise generation and wet the ground to minimize dust especially in the road construction
		• Destruction of plants, animals and habitats.	Ensure minimum disturbance to the ecosystem. Remove plants that can be saved and integrate the construction work with other area land use development work to find mechanisms to use soil, plant material and other removed material.

	Component	Environmental concerns	Mitigation
		• Use of building materials such as sand from sand dunes in the beach.	Ensure the environmentally sound supplies of sand, timber and other construction materials.
		• Potential water scarcity and ground water depletion.	Plan ahead for water supplies for construction. Already the groundwater system is challenged by sea water intrusion.
6	Use of heavy machinery	• Hydraulic and motor oil and other chemical leaks from machines.	Take precautions and minimize potential spills and accidents. Recycle motor oil and dispose other oils properly. Introduction of a good disposal system in the project could be a pilot project by itself that can be transferred to the community.
		• Noise and dust.	Take precautions, Arugam Bay is a very calm place with tourism as one of the key industries
7	Design and construction of water supply to Arugam Bay, Pottuvil and the vicinity.	• Adequate water in quantity and quality to cover the supply project area.	Conduct a detailed feasibility to evaluate the potential sources of water (ground and surface or a combination). Introduce water conservation measures in the design and educate the stakeholders about water efficiency and related energy efficiency. With the new infrastructure and area development the water consumption is expected to increase. Introduce rainwater harvesting designs and best practices to increase recharge through the awareness and development programs
		• Changes to surface water bodies.	Partitioning of lakes for water treatment needs extensive environmental assessments that include expansion to water retention area in lakes.
8	Implementation of waste management practices and awareness	• Pollution due to plastic and solid waste.	Design and introduce a plastic recycling system and a sound strategy to manage solid waste in the area. Work with local authorities and the community to introduce waste management through the project.
9	Monitoring and evaluation	• Lack of enforcement, environmental data collection and impact on the environment by different projects.	Establish a monitoring system that involves the local community, government, academics and local authorities.
		• Need to have continuous monitoring. Tourism impacts due to improved infrastructure and potential for new investments near sensitive areas, improved livelihoods etc. will change the system rapidly.	Appropriate fast response mechanisms are needed to respond to the changes. Establish a baseline data base and use it in awareness and progress monitoring. Monitoring system should be sustainable and should continue after the project completion.

3.2 Fisheries infrastructure and participatory coastal management components in the area.

Design and construct a mixture of repair, replacement, and new structures and facilities impacted by the tsunami. The projects sites are located at Hikkaduwa, Mirissa, and Puranawella (Dondra). The work will consist of repair and improvement of breakwater, wharfs, docks and pavements. The work may include shoreline work, dredging, and blasting. New developments include Fish flash freezing facilities, waste and wastewater processing facilities, fuel supply facilities, security improvements, and other improvement to other commercial fisheries related structures.

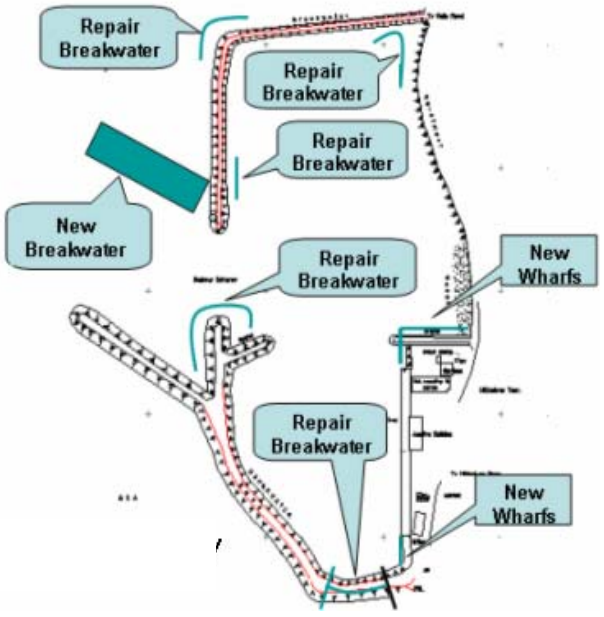
The increased berthing area within the harbor basin, improved facilities for fish unloading and improvements to other off shore activities (fish auction, net mending, weighing and data collection of fish catch etc) will boost the fishing industry. Present wastage in the fish industry due to poor handling and weaknesses in the storage is estimated at 30% - 40%. Adopting the high standards will enable the fishing industry to sell the products at a higher value to the export market, reduce their loan burden and bring positive impacts on social and economic conditions of the community.

Community led or participated activities, sustainable fishing activities, and other activities that benefit the greater population of the area are to be built in wherever possible and as identified by the community and local partners.

Hikkaduwa Fishery Harbor

Before the harbor construction the Lanka Hydraulics Institute, a leading research group associated with the University of Moratuwa, Sri Lanka conducted a modeling exercise and the model and the data are still available for any further modeling work related to rehabilitation or construction. The model uses a wave basin of 35 m x 25 m covering an area with 0.7 km x 1.0 km from the Hikkaduwa harbor to the river.

Figure 6: Hikkaduwa Harbor and Associated Construction work

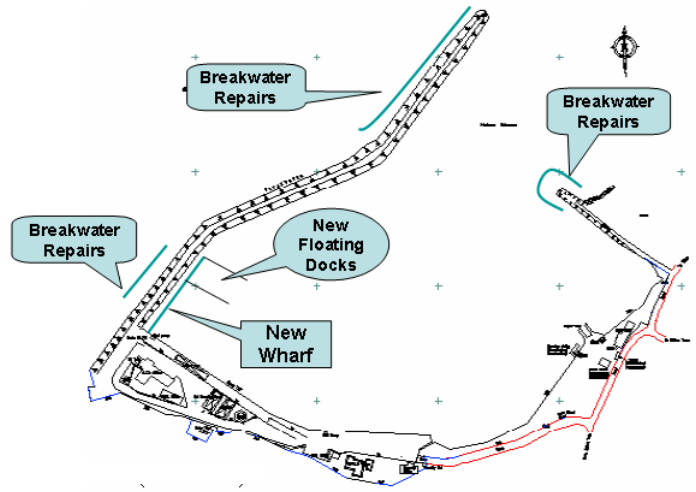


During the discussions with the Ceylon Fishery Harbor Corporation an extension to the present breakwater was requested. However, the Lanka Hydraulics Institute model conclusions do not support the idea. If USAID plans to support the extension of the south breakwater or add a breakwater in the north side of the entrance as proposed in the USACE proposal in March 2005, further studies may be needed to evaluate the sand movements, modification to the flow paths and erosion of the reef. The construction of the proposed breakwater will alter the hydrodynamic conditions within and in the vicinity of the harbor. The north bound current will be restricted and new eddy current patterns will be formed. Proposed changes to the entry will also change the flow pathways.

Mirissa fishery harbor

Mirissa harbor is designed to support the anchorage, supply and trade of the catch of 300 boats

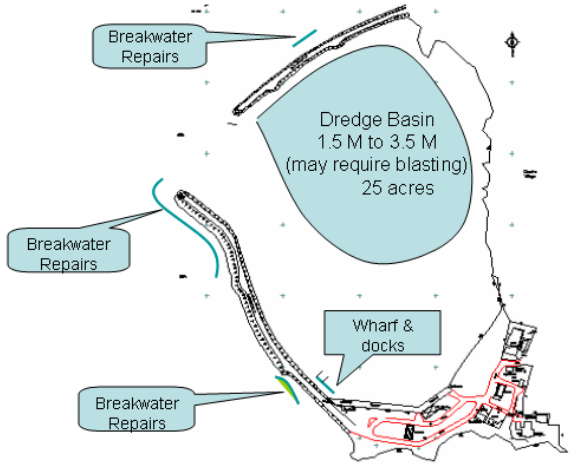
Figure 7: Mirissa Harbor and Associated Construction work



Dondra (Puranawella) fishery harbor

One of the sensitive activities in the proposed work is the dredging of the harbor to deepen the bay to about 3 to 3.5 meters. The mechanism for dredging and the mode of disposal are the primary concerns. The geology of the material to be dredged is inert and three options can be considered, namely, 1) the transport and disposal of the material in sea at selected locations avoiding fish breeding grounds and coral reefs; 2) use a cutter-suction dredger and pumping it out to nourish depleted beaches north of the harbor, and 3) separate limestone from the other material, sell lime and use the remainder as filling material for roads etc. Whatever process is undertaken it must be conducted with tight supervision and after ensuring that the material is free of contaminants. Some material can be used for the filling work done at the harbor itself. The previous dredged spoil site is 8 km out to the sea and the same site is used by the Beruwala fishery harbor dredging works.

Figure 8: Puranawella Harbor and associated construction work



The layout of the present breakwaters is finalized through a mathematical modeling work by the Lanka Hydraulic Institute Ltd. (LHI) in 1994. According to the findings of a master plan study of coastal erosion (DANIDA, 1986) the coastline changes resulting from the implementation of the breakwater construction is minimal. Also it was noted that the establishment of the breakwater minimized the progressive erosion in the Matara Bay that threatened the coastal lands and the Matara – Kataragama road.

3.2.1 Implementation Plan

Activity / Phase	Year 1				Year 2				Year 3				Year 4			
	FY 2005				FY 2006				FY 2007				FY 2008			
Draft RFP and IEE																
Pre - Bid conference																
Final RFP and contract award																
EA's Govt of SL and USAID approvals																
Inauguration of harbor projects																
Train harbor, local govt. and fishermen																
Identification of Monitoring Teams																
Designing of infrastructure projects																
Stakeholders design environ. projects																
Continuing stakeholder consultations																
Implementation of Infrastructure projects																
Environmental monitoring																
Project monitoring and evaluations																

3.2.2 Evaluation of environmental impact potential and recommended mitigation actions at Dondra (D), Hikkaduwa (H) and Mirissa (M).

	Description	Environmental Issues	Mitigation
1	<u>Replacement of breakwater</u> Dondra (D): 750 feet Hikkaduwa (H): 500 feet Mirissa (M): 650 feet <u>Construct/improve sea and channel entrances</u> D: Repair channel revetment and provide additional 1000 ft H: New 350 ft channel entrance M: Repair channel revetment and provide additional 300 ft	• New breakwater additions, if done, will impact the flow patterns, erosion and depositional behaviors of reefs.	Select and commission a study group (University, IUCN or NARA) to evaluate and monitor the conditions. There are ongoing studies as well in some harbors (eg: Hikkaduwa). Take the advantage of the studies conducted by the LHI for Hikkaduwa and Dondra in the design stage to better understand the fluid dynamics and erosion/depositions in and around the harbors.
	<u>Breakwater repairs</u> D: Approximately 1,700 feet of 12 feet wide H: 250 ft of breakwater and 1,500 ft of 12 ft wide pavement on top of the breakwater. M: Repair approximately 1,500 ft of 12 ft wide pavement on the breakwater	• Water quality (turbidity) deterioration due to construction and related problems such as impact to corals and tourism industry.	Use methods that minimize the disturbance and remove the disturbed material efficiently. Monitor the physical, chemical and biological parameters (EC, BOD, DO, pathogens, nutrients etc.). Bench mark before the construction, monitor during and after the construction.

	Description	Environmental Issues	Mitigation
	Repair/extension of wharfs D: Repair & addition of 300 ft H: Repair & addition of 400 ft M: Repair & addition of 450 ft	• Expansion of sea entrances may require blasting or other heavy duty equipment (noise and impacts).	Minimize the noise and vibration impact using covers and other techniques. Alert the community of the potential noise. Take safety precautions and remove and dispose of the debris with minimum damage to the ecosystem.
		• Raw materials for revetments may contain impurities that may dissolve in water later or be taken from illegal sources (timber, metal and sand).	Monitor the quality. Construction materials for the repair and new breakwater will be rubble mound structures. Boulders and quarry material used to be granite. Sizes of the material may vary and be obtained from the local quarry sites. There are incidents of sand mined at illegal locations and granite taken out from conservation sites etc. therefore, sources need to be verified.
		• Timely, UDA, CEA, Local Authority and CCD approvals.	Work with the Ceylon Fishery Harbor Corporation to get the environmental clearances
2	Dredging of the harbor Only for Dondra: About 25 acres of harbor area needs to be deepened from 1 meter to about 3 meters.	• Water quality (turbidity) deterioration due to dredging.	Take precautions to alert community, plan the work so that fishing activities will not disturb environmental preservation or vice a versa. Consider cleaning the coral structures after the operations (suction tubes).
		• Disposal of dredged material.	Investigate the best possible mechanism of disposal (sea, sorting, selling and filling or other options.
		• Noise and vibrations associated with dredging and constructions	Make the fishermen and residents and local authorities aware and take precautions to minimize the impact of under water vibrations.
3	Floating docks in and slipway/dry docks D: Two floating docks, a new 80 ton slipway/dry dock and replacement of 20' x 50' boat ramp. H: New 80 ton dry dock M: 200 ft of floating docs and 80 ton capacity dry dock	• Potential oil and other lubricant spills during the construction and use of the dry docks and slipways.	Introduce environmental management systems and create a culture of recycling. Convincing the fact that waste can bring money is a tested positive approach.
		• Excavations and other disturbances to create space for docks. •	Dispose the removed material properly. Working with area development plans may provide reuse opportunities.
4	New boat motor repair shops facilities at each location with 20’ x 70’	• Mechanisms to collect and dispose of used oil, solid waste and waste water.	Adopt a safety, fist aid and recycling system. Involve communities in this training too. Design and implement a mechanism to maintain boats to minimize major repairs and to save

	Description	Environmental Issues	Mitigation
			fuel. Most oil leaks are due to poor maintenance.
	<u>Fish mending, fish auction and other buildings</u> D: Add 40' to 27' x 80' fish auction facility, expand 20' x 60' to 80' for net mending and repair the pavements	• Disposal of damaged nets, fish waste and processing of solid waste.	Integrate waste management programs with the local authority system. It is expected that a model program originated at the harbor can lead the way to improved waste management in the area.
	H: New 80 ' x 30' fish auction facility, new administration buildings and net mending building repaired M: 40' addition to 27' x 80' fish auction building. New 20' x 60' net mending building and pavement repairs	• Erosion of exposed soil surfaces during construction.	Plan to cover the surfaces and landscape while the work is on going. Use the coir material, compost and other soil conservation measures to reduce the impact of high intensity rains common in the coastal area.
5	Ice- plant & flash freeze facilities added (capacities to be determined)	• Water quality issues in the vicinity due to disposal of fish waste.	Design systems of processing and use of waste. Fish waste can bring money as it is a good nitrogen source.
		• Adoption of new technology.	Create an educational system that explains the value addition to the fish catch as facilities improve. Use this as an opportunity to collect data on the volume of catch and the composition of the catch.
6	<u>Water and waste water</u> New systems to be designed and constructed at each location. The capacities to be decided.	• Identification of the right system for waste water treatment.	Consider recycling of water in the washing. Introduce water and energy efficiency programs as water can be scarce in the three harbor area.
		• Co-ordination with local authorities on waste water.	In Hikkaduwa the potential to integrate with the upcoming waste water project by the city. In other areas the harbor staff can get involved in the area waste water planning once the capacity is built.
		• Water purification needs for the harbor and the disposal of waste from the water purification system. This depends on the raw water used in the treatment.	Use of highly saline water as inputs to be avoided due to high cost of energy, cost of supplies and high discharges of waste water.
		• Increase use of water as a result of expansion. Introduce water conservation techniques and systems to reuse water after treatment.	Adopt rainwater harvesting to complement water supply by design.
7	<u>Improvements to fuel storage facility</u> Two 8000 gallon facilities to	• Oils spill containment and evaporation. Lack of understanding on the	Education may help with monitoring.

	Description	Environmental Issues	Mitigation
	be added and station improvements at all three harbors	volume of oil that can be evaporated during handling is an issue.	
		• Corrosion effects on the tanks and leak tests.	Proper systems and procedures need to be followed to reduce the corrosion.
8	Fish waste and other solid waste management: Facility to recycle up to 6 tons per day fish waste and an integrated solid waste management system at each location	• Integration of solid waste disposal with the local authority system.	It is important to involve the community and local authorities in the design. To ensure the economics of scale the Fishery Harbor Corporation can introduce a fish waste management program in the community to capture the waste discarded by fishermen who use landing points.
9	Multipurpose community facilities Each harbor will have a newly designed facility that will include a visitor center, sales outlet and a canteen. Sizes and the scope are to be determined and Hikkaduwa center will be the most sophisticated one with green designs etc.	• Waste management (solid and liquid).	Use education and financial benefits to promote sustainable waste management. Introduce techniques to dispose waste and generate energy (biogas, composting etc.) and use the harbor project as a model to encourage communities to do the same.
		• Ensuring the full use of the community center.	Design and implement a program that will be appreciated by the community and the fishermen. Proper use of the community facility can have a number of benefits and provide an enabling environment for stakeholders to get together.
10	Monitoring and evaluation	• Lack of data on weight of the catch and composition.	Establish a data collection system and convince the stakeholders of the value of doing so.
		• Poor financial performance by the fishery harbors.	Work with the system to improve the economy of the fisher community using the infrastructure and technical assistance provided and convert harbors as separate cost centers.
		• Lack of systems for continuous monitoring of the impacts of the projects.	Need to identify a community, regulatory and scientific team and provide facilities to implement a designed monitoring protocol covering the adoption of environmental best practices, water quality and quantity related parameters and any other identified variable. This system should continue after the project, therefore, build sustainable financing into the design.

3.3 Rehabilitation of damaged vocational training facilities and new construction

The exact details of the design and constructions at each sites is not available at this time. A team of USAID staff is in the process of collecting data, evaluating the possibility of combining several centers, modifying curricula and designing the need and use for the proposed state–of–the–art facilities that are to be designed and build.

This review, therefore, may not include much detail as compared to the projects on Arugam Bay development and fishery harbor improvements.

3.3.1. Implementation Plan

Activity / Phase	Year 1	Year 2	Year 3	Year 4
	FY 2005	FY 2006	FY 2007	FY 2008
Draft RFP and IEE				
Pre - Bid conference				
Final RFP and contract award				
Identification of actual sites and curricula				
Green design of buildings				
EA's Govt of SL and USAID approvals				
Ground Breaking				
Stakeholder and community involvement				
Repair of damaged buildings				
Const. of new state of the art facilities				
Curricula development for new facilities				
Equipping damaged and new facilities				
Implementation of waste and energy mgt.				
Evaluation				
Independent monitoring				

3.3.2. Evaluation of Environmental Impact and Potential and recommended mitigation actions

	Component	Environmental concerns	Mitigation
1	Site identification of a land to relocate damaged buildings and new sites identified for state – of – the art new facilities	• Need to move people or site is near a sensitive area.	Work with local authorities to minimize the impact. It is better to avoid displacement of families, if possible. Look for the adequate space for expansion and installation of waste management facilities in the premises in the new proposed facilities.
2	Debris removal and site preparation	• Demolition of structures.	Adopt appropriate precautions to minimize harmful effects of dust, asbestos and metal and recycle as much material as possible.

	Component	Environmental concerns	Mitigation
		• Exposing the bare soil can cause erosion of sediments and disturbance to the ecosystem. High intensity rainfall in the coastal area can induce severe erosion on loosely exposed soils	Use cover methods and compaction and plant cover crops or landscape. Landscaping with coir material to provide initial cover is one solution. Include erosion controls in the designs.
3	Planning for environmentally friendly designs	• Excessive use of water and energy in new facilities may reduce the sustainability.	Once built the Government is responsible for the maintenance and obtaining recurrent expenses is difficult, therefore, minimizing the operational cost by design is a good strategy. Green designs may help with this and introducing water and energy conservation methods can be incorporated. Waste management coupled with energy generation (biogas) and rainwater harvesting are proven methods in Sri Lanka. In addition, building design to reduce air-conditioning and lighting loads are needed. Work with the community and local authorities to replicate the models established.
		• Design for sustainability.	Two to three new facilities will be build in the east and south based on the results of the workforce development study by USAID Sri Lanka. These buildings will be designed to suit the type of training need (identified by the study) and include green building designs. The buildings themselves can serve as models to the teachers, students and the community.
		• Evaluation of the benefits of new designs	A system to compare the economic and environmental savings as a result of good practices is a must to facilitate the promotion of the environmentally and economical designs. This could be a part of the monitoring program in the project.
4	Construction of buildings and access roads	• Excavations can cause erosion, siltation, changes in natural water flow and damage ecosystems when excavated soil is piled inappropriately.	Take precautions to protect the erosion of freshly dug soils, and cover and reuse as quickly as possible. Be aware of drainage water flow pathways in the site and the water bodies nearby.
5	Small-scale sanitation	• Waste and waste water discharges.	Design systems to treat water at the premises or proper hook up to the

	Component	Environmental concerns	Mitigation
			main system, if available. Adopt energy generation techniques in waste disposal. There may be uses for treated waste water in the community.
6	Solid waste management	• Lack of systems for solid waste disposal.	Use the facility system as a model to improve the solid waste management in houses and in the local authority area.

4. SUMMARY OF FINDINGS AND ENVIORNMENTAL DETERMINATIONS

Project Area	Threshold Determination	Remarks
Arugam Bay area infrastructure and area development • New bridge and access road • Bypass road • Arugam Bay and Pottuvil water supply and sanitation • Arugam Bay and vicinity participatory area development including coastal management	Positive determination for the first three actions and the categorical exclusion for the last action	This activity requires the conduct of an Environmental Assessment (EA) to access the environmental impact and identify the steps to mitigate the impacts pursuant to CFR 216 regulations.
Rehabilitation and improved harbor and area environmental management of fishery harbors • Dondra (Puranawella) harbor • Hikkaduwa harbor • Mirissa harbor • Capacity building and improved environmental management	Positive determination for the first three actions and the categorical exclusion for the last action	This activity requires the conduct of an Environmental Assessment (EA) to access the environmental impact and identify the steps to mitigate the impacts pursuant to CFR 216 regulations.
Rehabilitation and improvements to vocational and educational centers • Repair or relocate tsunami damaged facilities and provide equipment • Combining two or more tsunami damaged vocational educational centers, making modifications to curricula and providing equipment • Design and construction of two to three new state – of – the art vocational educational centers • Adoption of best environment and energy management practices	Positive determination for the first three actions and the categorical exclusion for the last action	Detailed site specific information for this activity is not available. However the type of activity indicates the need for an Environmental Assessment (EA), at least for selected sites. Some sites may not have a sufficient footprint or impacts to conduct an EA.

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